ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AAABH01280
Data Sensitivity: No

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Rana subaquavocalis*
COMMON NAME: Ramsey Canyon Leopard Frog
SYNONYMS: *Rana chiricahuensis*
FAMILY: Anura: Ranidae

AUTHOR, PLACE OF PUBLICATION: Platz. 1993. J. of Herpetology 27(2): 154-162.

TYPE LOCALITY: Ramsey Canyon, 7 km southwest of Sierra Vista, Cochise County, Arizona.

TYPE SPECIMEN: HT: AMNH 136096. J.E. Platz, 24 May 1990.

TAXONOMIC UNIQUENESS: *Rana* is a large genus, including Old and New World species (Stebbins 1985). Once thought to be a single species, the *Pantherana* clade (informally termed as *Rana pipiens* complex) contains 30 species within Middle and North America and 7 species within Arizona (6 native and 1 introduced), (Hills 1988; Hillis and Wilcox 2005). In 2004, genetic analysis (mtDNA sequences) was used by Goldberg, Field and Sredl to investigate the phylogenetic relationship of *Rana subaquavocalis* and *R. chiricahuensis* from localities throughout their Arizona range. They found two distinct lineages of *R. chiricahuensis*, one on the Mogollon Rim of central Arizona (northern population) and one in southern Arizona (southern population) and concluded that these two lineages could represent two distinct species, but suggested that a detailed examination of behavioral, ecological, and morphological differences between the two groups be conducted before this is determined. The *Rana subaquavocalis* samples from the Goldberg et al. (2004) study were on a short branch within the southern Arizona clade of *R. chiricahuensis*. The results are consistent with the hypothesis that *chiricahuensis* and *subaquavocalis* are conspecific. (NatureServe 2006). Based on a conversation with Sredl in the Fall of 2006 (Susan Schuetze pers. comm.), a nuclear DNA study is under way at the University of Arizona to determine the taxonomic placement of the northern population of *R. chiricahuensis* (to elevate to separate species or not), and to definitively determine if *R. subaquavocalis* is conspecific with *R. chiricahuensis*. However, for the time being and for this abstract, the HDMS is tracking these two Rana's as separate species, and the northern and southern populations of Chiricahua leopard frogs as *R. chiricahuensis*. The USFWS Draft Recovery Plan (2005) for the Chiricahua leopard frog treats the Ramsey Canyon leopard frog (*R. subaquavocalis*) as *R. chiricahuensis* because it is likely to be recognized as such in the near future.

DESCRIPTION: Like other ranid frogs, *R. subaquavocalis* is highly aquatic with webbed hind feet. Snout-ventral length averages 8.3 cm (3.24 in) for males, 10.5 cm (4.2 in) for females. A relatively rough-skinned leopard frog, coloration is green to olive-brown dorsally, with round to elongated large brown spots. The thigh pattern is salt and pepper like, formed by small whitish tubercles on the dark thighs. Dorsolateral folds are broken towards the rear and inset medially. There is an incomplete lip stripe on the upper jaw. As in the very similar *R. chiricahuensis*, eyes are upturned and set high on the head. Adult males can be distinguished from females by the presence of prominent, gray thumb pads and external vocal sacs. Males have well-developed vestigial oviducts. Adult females have pigmented ovarian eggs, which are lacking in juvenile specimens. When originally described, it was thought that *R. subaquavocalis* only produced mating calls while completely submerged underwater and that the calls were inaudible in air (Platz 1993b). Further observation has indicated that the males also produce audible calls and probably do so with their heads above the water's surface. When heard above water, the call is similar to that of the Chiricahua leopard frog (Rorabaugh *in* AZ PARC 2006).

AIDS TO IDENTIFICATION: *R. subaquavocalis* is large, with small white tubercles forming a salt and pepper pattern on the dark rear thighs. The species is found only in the Huachuca Mountains.

ILLUSTRATIONS:

B&W photo (Platz 1993b: 155)
Color photo (Jordon A. Perrett, *in* AZ PARC 2006, http://www.reptilesofaz.com)
Color photo (Eric M. Rundquist, *in* CNAH 1994-2006, http://www.naherpetology.org/detail.asp?id=1178)
Color photo (Cecil R. Schwalbe, *in* Tucson Herpetological Society, accessed 2006, http://www.arts.arizona.edu/herp/RASU.html)

TOTAL RANGE: *R. subaquavocalis* is only found on the east side of the Huachuca Mountains in Cochise County, Arizona. Its current range is limited to aquatic habitats in Brown and Ramsey canyons. There is speculation that the historical range may have included the San Pedro River Valley and parts of Chihuahua, Mexico (Platz 1997). Unconfirmed Ramsey Canyon leopard frog historical records for the Huachuca Mountains include Ash, Bear, Carr, Copper, Garden, Hunter, Miller, Montezuma, Parker, Scotia, and Sunnyside canyons (Sredl, *in* Lannoo 2005). There are no recent records from these sites.

Goldberg et al. (2004) reports that *R. subaquavocalis* is currently found in five canyons on the east side of the Huachuca Mountains, due to intensive conservation actions and translocation efforts.

RANGE WITHIN ARIZONA: See "**Total Range**."

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Adults are able to reach at least 10 years of age post-metamorphosis (Platz et al. 1997). Although detailed study on movement of adults has not been done, marked frogs have moved several hundred meters within Ramsey Canyon (M. Sredl unpublished data). The basic biology of this frog is similar to that of most other ranid frogs. According to Sredl (*in* Lannoo 2005), "Other anurans that occur with Ramsey Canyon leopard frogs include Canyon treefrogs (*Hyla arenicolor*), Woodhouse's toads (*Bufo woodhousii*), red-spotted toads (*Bufo punctatus*), Mexican spadefoot toads (*Spea multiplicata*), and American bullfrogs (unpublished data). Couch's spadefoot toads (*Scaphiopus couchii*), Sonoran Desert toads (*B. alvarius*), Arizona treefrogs (*H. wrightorum*), and lowland leopard frogs could either occur incidentally or may have occurred historically with Ramsey Canyon leopard frogs (unpublished data)." Likely predators include garter snakes, bullfrogs, rats, foxes, coyotes, ring tail cats, coatis, black bear, badger, skunks, bobcats, mountain lions, and various aquatic invertebrates including belostomatids (Platz 1997).

REPRODUCTION: Although Platz (1997) suggested that sexual maturity is reached rather late in life at approximately 6 years post-metamorphosis, frogs captive reared at The Phoenix Zoo and released in Miller Canyon produced egg masses one year after metamorphosis. Reproduction is aquatic. Males call underwater while submerged as deep as 1.4 m (Platz 1997, cited by Sredl *in* Lannoo 2005). Although they are thought to produce calls that are inaudible in air, workers have heard calling males at the type locality (personal observations, cited by Sredl *in* Lannoo 2005). Whether these vocalizations were produced while the male was above or below the water's surface, is unclear. Males vocalize from at least mid-March through mid-July (Platz 1993a). Egg masses have been recorded from mid-March through early October (AGFD unpublished data). Females are likely capable of double clutching (Platz 1997, cited by Sredl *in* Lannoo 2005). Mating seems to begin once water temperatures have reached at least 10 ºC (50 ºF) and oviposition may be correlated with temperatures rather than rainfall. Although amplexus may last 8-20 hours, oviposition is brief (Platz 1997). Eggs are laid in spherical masses, attached to submerged vegetation at a mean depth of 26.9 cm, so that the egg mass is held near the surface of the water. Egg masses contain approximately 1,518 eggs, which hatch in about 14 days in the wild, depending on temperature (Platz 1997). In captivity, eggs hatch in about 10 days when held at 23-25 ºC (73-77 ºF) (M. Demlong unpublished data). Larvae metamorphose in the year they were oviposited or may over-winter as tadpoles (Platz and Grudzien 1993, Platz 1996, Platz et al. 1997). Larvae metamorphose in as few as 100 days in captivity, but frequently take 160 - 200 days (M. Demlong unpublished data).

FOOD HABITS: The diet of *R. subaquavocalis* has not been studied in the wild. It is assumed that the diet is similar to other leopard frogs, which includes arthropods, other invertebrates, and small vertebrates (Stebbins 1951). Tadpoles are herbivorous. Large tadpoles have been observed consuming the gelatinous envelopes of eggs, but may not consume the ova (Platz 1996).

HABITAT: Adults inhabit aquatic systems such as springs, cienegas, earthen tanks, small creeks, and slack waters of main-stem rivers. These same habitats also provide reproduction sites. (Sredl et al. 1997; Sredl, *in* Lannoo 2005).

ELEVATION: In the Huachuca Mountains, they can be found from 4,750 feet (1448 m) in Carr Canyon to 6,400 feet (1951 m) in Miller Canyon. They are also found at a refugia pond east of the Huachuca Mountains at 4,570 feet (1393 m). (HDMS, AGFD unpublished data, accessed 2007).

PLANT COMMUNITY: Habitats are found in pine-oak, oak woodland and semi-desert grassland areas of the Huachuca Mountains. Vegetation at aquatic sites is variable but includes horsetail (*Equisetum* ssp.), spikerush (*Eleocharis* ssp.), cattail (*Typha* ssp.), watercress (*Rorippa*), monkey flower (*Mimulus*), and grasses. Emergent vegetation and root masses provide cover sites. Other sites are sparsely or seasonally vegetated with introduced or native grasses such as deer grass (*Muhlenbergia rigens*), Bermuda grass (*Cynondon dactylon*), and Johnson grass (*Sorghum halepense*). (M. Sredl unpublished data; also cited by Sredl *in* Lannoo 2005).

POPULATION TRENDS: Populations appear to be declining and recruitment is low at all known localities. Frogs released in Miller Canyon in 1999 produced at least 28 egg masses in 2000 and the population appeared to be doing well. At two sites, Tinker Pond and Ramsey Canyon, chytrid fungus (see Additional Information) has been found in dead frogs. This fungus has been implicated in the declines of amphibians around the world (Berger et al. 1998) and may play a role in the decline of *R. subaquavocalis*.

According to NatureServe (2006), "one known breeding site in recent years; probably fewer than 100 breeding adults; threats include non-native aquatic animals, disease, and drought…"

This frog is currently found in five canyons on the east side of the Huachuca Mountains through intensive conservation actions, including translocations (Goldberg et al. 2004).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: None (USDI, FWS 1997)
[C USDI, FWS 1996]
[C1 USDI, FWS 1994]

STATE STATUS: None

OTHER STATUS: Bureau of Land Management Sensitive (USDI, BLM AZ 2008)
Forest Service Sensitive (USDA, FS Region 3 1999)
CR (2001 IUCN Red List)

MANAGEMENT FACTORS: A conservation assessment was developed in 1996 (Platz 1996) and was followed by the signing of a conservation agreement. AZ Game & Fish Dept., U.S. Fish & Wildlife Service, U.S. Forest Service, DOD Fort Huachuca, The Nature Conservancy, and a private land owner are signers of the agreement. Loss of habitat, including those areas affected by persistent drought, and the possible presence and infection of a chytrid fungus are threats to this species. Although the relationship between non-native predators (e.g., American bullfrog [*R. catesbeiana*], crayfish, and predatory fish) and Ramsey Canyon leopard frogs have not been studied in detail, there is a negative co-occurrence between other native leopard frog species and introduced predators (Rosen et al. 1998, cited by Sredl *in* Lannoo 2005).

PROTECTIVE MEASURES TAKEN: Arizona Game and Fish Commission Order 41 prohibits the collection of *R. subaquavocalis* from the wild in Arizona. Water flow has been maintained in several pond sites. Eggs and larvae have been collected and reared in captivity to increase initial survival rates. The captive reared frogs and larvae have been released at several sites including Ramsey Canyon, the Barchas Ranch, and Miller Canyon.

SUGGESTED PROJECTS: Survival rates of released frogs, could be determined through a mark-recapture study. Habitat requirements and life history information could be gathered through radio-telemetered animals. Studies focusing on factors that may play a role in population declines, including the disease caused by chytrid fungus would be valuable.

LAND MANAGEMENT/OWNERSHIP: DOD - Ft. Huachuca; USFS – Coronado National Forest; The Nature Conservancy – Ramsey Canyon Preserve; Private.

SOURCES OF FURTHER INFORMATION

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Caren Goldberg – University of Arizona, 125 Biosciences East, Tucson, Arizona.

ADDITIONAL INFORMATION:

The genus name *Rana* (true frog) is Latin for frog, and probably mimics how the Romans heard their call. The species name *subaquavocalis* refers to the habit of males to call from underwater. Latin *sub-* below and Latin *aqua* water and Latin *vocalis* calling from. (Beltz, 2006).

Head-started individuals have been documented to live for at least 3 years after release in Ramsey Canyon (K. Field unpublished data).

"Chytridiomycosis is a recently recognized cutaneous infection of both wild frogs and toads (Berger et al., 1998; Bosch et al., 2000) and captive frogs (Pessier et al., 1999) caused by the fungal agent *Batrachochytrium dendrobatidis*. … Clinical signs include lethargy, abnormal posture, loss of the righting reflex, and death (Daszak et al., 1999). The infection results in a severe diffuse dermatitis characterized by epidermal hyperplasia, hyperkeratosis, and variable degrees of cutaneous ulceration and hyperemia." (Bradley et al., 2002).

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